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Some Notes on the Corneal Astigmatism in Two Hundred Eyes measured with the Ophthalmometer of Javal, in Comparison with the Total Subjective Astigmatism after Complete Mydriasis.

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Some Notes on the Corneal Astigmatism in Two Hundred Eyes measured with the Ophthalmometer of Javal, in Comparison with the Total Subjective Astigmatism after Complete Mydriasis.

THE ophthalmometer of Javal and Schiötz requires no introduction. Its advantages as a practical instrument are everywhere recognized, and even those who look upon its readings with misgivings are not inclined, I think, to disregard it entirely or set it aside in the lumber-room. True, it has sometimes suffered from unduly enthusiastic advocacy, but plenty of conservative estimates of its undoubted value are extant, and may be consulted for trustworthy information.

It will be interesting for a moment to give a brief *résumé* of the rise of ophthalmometry with this instrument in the United States. To Dr. Swan M. Burnett, of Washington, belongs the credit of having been the first one in this country to advocate its use, and to demonstrate its practical importance, in a paper entitled "Ophthalmometry with the Ophthalmometer of Javal and Schiötz, with an Account of a Case of Keratoconus," which appeared in 1885.* Two years later his treatise on astigmatism was published, containing a description of the instrument and of its importance as a means of measuring the corneal astigmatism. One year later he recorded an exhaustive analysis of the refraction of more than five hundred healthy human corneæ examined with the ophthalmometer of Javal and Schiötz;† and in the discussion which followed this paper, Dr. Henry D. Noyes praised the ophthalmometer, stating that it was his habit to employ it in every case where it was necessary to inquire into the refraction of the eye. In his work on diseases of the eye there is an excellent description of

the instrument and the method of using it. In the years which have followed, we find papers on the subject of ophthalmometry with this instrument by H. D. Speakman,‡ by Koller,§ and an earnest advocacy of its employment by Roosa,||—an advocacy which has never ceased, and which has never been couched in words of an uncertain tone.

In November, 1891, Dr. F. W. Ring¶ published a good account of the ophthalmometer and its uses, based upon personal conversations with Tscherning, Bull, of Paris, and Javal, and upon notes selected and compiled from the "Mémoires d'Ophthalmométrie." At the forty-second annual meeting of the American Medical Association, held in Washington, May, 1891, Dr. Burnett placed upon record further contributions to keratometry, reviewing his previous work, and reiterating his favorable opinion of the ophthalmometer. In the present year articles upon this subject have been written by E. Swasey,** Roosa, Würdemann,†† Van Fleet,‡‡ and others; while Valk, in the new edition of his "Errors of Refraction," gives a careful description of the ophthalmometer of Javal, and records a table of comparative examinations.

Some unfavorable comments have been

‡ *Archives of Ophthalmology*, vol. xix., 1890, and *New York Medical Record*, vol. xxxvii., 1890.

§ *Journal of the American Medical Association*, 1890, xv. 380 to 383.

|| *Medical Record*, April 19, 1890; *New York Medical Journal*, March 28, 1891; *Medical Record*, March 26, 1892.

¶ *Ophthalmic Record*, November, 1891.

** *Boston Medical and Surgical Journal*, March 10, 1892, cxxvi. pp. 232-236.

†† *Journal of the American Medical Association*, September 3, 1892.

‡‡ *New York Medical Journal*, July 9, 1892.

* *Archives of Ophthalmology*, vol. xiv.

† *Transactions of the American Ophthalmological Society*, 1888.

published, together with a series of tables not unlike the one which I hope to present this evening, by Dr. J. H. Woodward;* but even in this paper, although objections are made to certain inaccuracies, according to the belief of this author, he frankly admits that the ophthalmometer is a useful adjunct, and helps to point the way to the diagnosis of astigmatism, being especially satisfactory when this refractive defect is of high degree.

The most recent communication upon the subject in this country are the papers of A. E. Davis,† containing, as it seems to me, the best practical directions for using the instrument accurately. I have not attempted to give references to the many foreign papers upon this subject; any one interested will find quite a complete bibliography in Javal's "Mémoires."

Thus we see that from the publication of Dr. Burnett's paper in 1885 up to the present time numerous communications have appeared in this country, many of them strongly advocating the employment of this instrument.‡

Practically there has been little or no dissent from the views which Burnett advocated nearly eight years ago, and it seems eminently proper that Javal should characterize him, which I am sure we are all glad to do, as the champion of ophthalmometry in America.

The cases which I present for your consideration this evening comprise the last two hundred patients who came in private practice for an examination of refractive defects, exactly in the order in which they presented themselves. Each case, after the usual tests for visual acuity, the amplitude of accommodation, and the balance of the external ocular muscles, was examined with the ophthalmometer of Javal and the reading carefully recorded. The eyes were then subjected to complete mydriasis, with atropine, hyoscyamine, or cumulative instillations of homatropine, and a comparison made with the previous results. In the cases under thirty years of age, hyoscyamine or atropine was employed; in those over this age cumulative instillations of homatropine. In each instance a complete paralysis of the ciliary muscle was obtained, because I am one of those who believe that this

can be done with a strong solution of homatropine when properly employed, and, as is well known, I have full support in this belief from such careful observers as Risley, Randall, and Jackson.

From these observations the tables were arranged, as will be seen, by placing first the case number, then the sex of the patient, followed by the age, the ophthalmometer reading, the glass selected after a mydriatic, the difference in the axes, and, finally, the difference in the amount of astigmatism, provided there was any difference in these respects. In recording the ophthalmometer reading, it might have been written as Davis has suggested, for example, "Astigmatism with the rule 1 D axis $90^{\circ}+$, or axis $180^{\circ}-$." Again, "Astigmatism against the rule $180^{\circ}+$ or $90^{\circ}-$." In order to save space, however, this repetition has been omitted, and, for example, the ophthalmometer reading is recorded thus: O. S. 3 D axis 180; glass selected after a mydriatic,— 2.75° axis 180, and not, as might have been done following the suggestion just quoted, O. S. 3 D axis $90+$, or axis $180-$; glass selected after a mydriatic,— 2.75° axis 180. The tables follow. I desire to thank my assistant, Dr. John Haden, for help in making the records.

Many of the degrees of astigmatism are weak, representing .25 D, .37 D, and .50 D, or, in other words, indicating that a reading was made in fractions of a dioptre, according to the amount of overlapping of the steps of the reflector. Now, it is a difficult matter to assure one's self that the corneal images of the reflector are exactly in apposition, and there is no doubt that it is easy to commit an error of .25 or .37 D when the first adjustment of the ophthalmometer is made. To a certain extent this depends upon the skill of the observer, but it none the less introduces a small element of doubt. Woodward, whose article has been referred to, writing concerning this point, says, "In the appended reports I wish to be understood. I don't pretend to accurately bisect the image of one-half of one step of the reflector. When the reading is, for example, .25 or .75, I wish to convey the idea that the overlapping of the reflector was, as nearly as I could estimate it, one-quarter or three-quarters of the step." This is, of course, a fair statement, and applies in the present instance. I presume no one would pretend to estimate exactly one-quarter of the step. Still practice develops reasonable accuracy, just as it does in a cataract extraction, where we are accus-

* Ibid., July 16, 1892.

† Ibid., September 10, 1892.

‡ It should be stated that Dr. C. Weiland has made a study of what he believes to be the main defects of the ophthalmometer of Javal from a mathematical standpoint, and has published his research in the *Medical News*, 1892, lx. pp. 626-629.

TABLE I.—*Astigmatism according to the Rule.*

Case.	Sex.	Age.	Ophthalmometer reading.	Glass selected after mydriatic.	Difference in axes.	Difference in the amount of astigmatism.	Remarks.
2	F.	46	O. D. .50 D axis 75.	O. D. + .50 ^s C + .62 ^c axis 75 ⁶ / ₈ .	None.	.12 D.	.12 D more than ophthalmometer reading.
3	F.	25	O. S. .50 D axis 120. O. D. .50 D axis 90. O. S. .50 D axis 105.	O. S. + 1 ^s C + .25 ^c axis 120 ⁶ / ₈ . O. D. + .62 ^c axis 90 ⁶ / ₈ . O. S. + .62 ^c axis 105 ⁶ / ₈ .	None. None. None.	.25 D. .12 D. .12 D.	.12 D more than ophthalmometer record.
4	M.	15	O. D. 1 D axis 75. O. S. 1 D axis 90.	O. D. + 2 ^s C + .75 ^c axis 75 ⁶ / ₈ . O. S. + 2 ^s C + .75 ^c axis 90 ⁶ / ₈ .	None. None.	.25 D. .25 D.	
6	M.	40	O. D. 2 D axis 175. O. S. 3 D axis 180.	O. D. — 1.75 ^c axis 175 ⁶ / ₈ . O. S. + .75 ^s C — 2.75 ^c axis 180 ⁶ / ₈ .	None. None.	.25 D. .25 D.	
7	M.	27	O. D. .50 D axis 105. O. S. No astigmatism.	O. D. + .50 ^s C + .25 ^c axis 105 ⁶ / ₈ . O. S. + .75 ^s C + .12 ^c axis 75 ⁶ / ₈ .	None. .....	.25 D. .12 D.	
9	M.	42	O. D. 1.50 D axis 90. O. S. Blind.	O. D. + 1.25 ^c axis 90 ⁶ / ₈ . O. S.	None. .....	.25 D.	Detachment of retina.
10	F.	13	O. D. .50 D axis 90. O. S. .50 D axis 75.	O. D. + 1 ^s C + .50 ^c axis 90 ⁶ / ₈ . O. S. + .75 ^s C + .62 ^c axis 75 ⁶ / ₈ .	None. None.	None. .12 D.	
11	F.	18	O. D. .50 D axis 105.	O. D. + 4.25 ^s C + 62 ^c axis 105 ⁶ / ₈ .	None.	.12 D.	.12 D more than ophthalmometer record.
13	F.	34	O. S. .75 or 1 D axis 75. O. D. .50 or .75 D axis 90. O. S. .50 or .75 D axis 105.	O. S. + 5 ^s C + .62 ^c axis 75 ⁷ / ₈ . O. D. + 50 ^c axis 90 ⁶ / ₈ . O. S. + .50 ^c axis 105 ⁶ / ₈ .	None. None. None.	.13 D. .25 D. .25 D.	
14	M.	46	O. D. .50 D axis 90. O. S. No astigmatism.	O. D. glass rejected ⁶ / ₈ . O. S. glass rejected ⁶ / ₈.	.....	.50 D.	
15	M.	31	O. D. 1 or 1.25 D axis 15.	O. D. + .50 ^s C + 1 ^c axis 15 ⁶ / ₈ .	None.	.25 D.	Astigmatism contrary to rule
18	M.	48	O. S. .50 or .75 D axis 150. O. D. .75 D axis 90. O. S. .75 D axis 90.	O. S. — .50 ^c axis 150 ⁶ / ₈ . O. D. + .50 ^c axis 90 ⁶ / ₈ . O. S. + .50 ^c axis 90 ⁶ / ₈ .	None. None. None.	.25 D. .25 D. .25 D.	
21	F.	30	O. D. 1 D axis 90. O. S. 1 D axis 75.	O. D. + 2.50 ^s C + .75 ^c axis 105 ⁶ / ₈ . O. S. + 2.50 ^s C + .87 ^c axis 90 ⁶ / ₈ .	15°. 15°.	.25 D. .12 D.	
22	F.	28	O. D. 2.50 D axis 150. O. S. 2 D axis 30.	O. D. — .75 ^s C — 2.25 ^c axis 150 ⁶ / ₈ . O. S. — .50 ^s C — 1.75 ^c axis 30 ⁶ / ₈ .	None. None.	.25 D. .25 D.	
23	F.	17	O. D. .75 D axis 90. O. S. .75 D axis 105.	O. D. + 1.25 ^s C + .50 ^c axis 90 ⁶ / ₈ . O. S. + 1.25 ^s C + .50 ^c axis 105 ⁶ / ₈ .	None. None.	.25 D. .25 D.	
24	F.	54	O. D. 1 D axis 90. O. S. .50 or .75 D axis 90.	O. D. + .87 ^c axis 90 ⁶ / ₈ . O. S. + .62 ^c axis 90 ⁶ / ₈ .	None. None.	.12 D. .12 D.	
25	F.	19	O. D. 1 D axis 105. O. S. .50 or .75 D axis 75.	O. D. + .75 ^c axis 105 ⁶ / ₈ . O. S. + .25 ^s C + .50 ^c axis 75 ⁶ / ₈ .	None. None.	.25 D. .25 D.	
26	F.	22	O. D. 1 D axis 15. O. S. 2.50 D axis 165.	O. D. — 2 ^s C — .87 ^c axis 15 ⁶ / ₈ . O. S. — 5 ^s C — 2.25 ^c axis 165 ⁶ / ₈ .	None. None.	.12 D. .25 D.	
27	M.	24	O. D. 75 D axis 100. O. S. 1 D axis 80.	O. D. + 1.25 ^s C + .62 ^c axis 100 ⁶ / ₈ . O. S. + 1.25 ^s C + .62 ^c axis 80 ⁶ / ₈ .	None. None.	.13 D. .38 D.	
29	F.	21	O. D. 1 D axis 90. O. S. 1 D axis 80.	O. D. + .75 ^s C + .75 ^c axis 90 ⁶ / ₈ . O. S. + .75 ^s C + .87 ^c axis 75 ⁶ / ₈ .	None. 5°.	.25 D. .12 D.	
30	M.	45	O. D. .75 or 1 D axis 90. O. S. .50 D axis 90.	O. D. + 1 ^s C + .75 ^c axis 90 ⁶ / ₈ . O. S. + .75 ^s C + .25 ^c axis 90 ⁶ / ₈ .	None. None.	.25 D. .25 D.	
31	F.	55	O. D. .75 D axis 105. O. S. .50 D axis 75.	O. D. + 1 ^s C + .50 ^c axis 105 ⁶ / ₈ . O. S. + 1 ^s C + .50 ^c axis 75 ⁶ / ₈ .	None. None.	.25 D. None.	
32	F.	23	O. D. .50 D axis 90. O. S. 1.50 D axis 110.	O. D. + 2 ^s C + .50 ^c axis 90 ⁶ / ₈ . O. S. + .50 ^s C + .75 ^c axis 125 ⁶ / ₈ .	None. 15°.	None. .75 D.	
33	F.	30	O. D. .50 D axis 90. O. S. .50 D axis 90.	O. D. + .75 ^s C + .75 ^c axis 90 ⁶ / ₈ . O. S. + .75 ^s C + .75 ^c axis 90 ⁶ / ₈ .	None. None.	.25 D. .25 D.	.25 D more than ophthalmometer record. .25 D more than ophthalmometer record.
34	M.	21	O. D. .50 D axis 90. O. S. .50 D axis 90.	O. D. + 1.25 ^s C + .37 ^c axis 90 ⁶ / ₈ . O. S. + 1.50 ^s C + .37 ^c axis 75 ⁶ / ₈ .	None. 15°.	.13 D. .13 D.	
35	F.	38	O. D. .50 D axis 90. O. S. .50 or .75 D axis 105.	O. D. + 1.25 ^s ⁶ / ₈ . O. S. + 1.25 ^s C + .25 ^c axis 105 ⁶ / ₈.	..... None.	.50 D. .50 D.	
36	M.	44	O. D. 1 D axis 90. O. S. 1 D axis 105.	O. D. + .50 ^s C + .50 ^c axis 90 ⁶ / ₈ . O. S. + .50 ^s C + .75 ^c axis 90 ⁶ / ₈ .	None. 15°.	.50 D. .25 D.	
38	F.	31	O. D. .75 D axis 90. O. S. .75 D axis 105.	O. D. + .50 ^c axis 90 ⁶ / ₈ . O. S. + .62 ^c axis 90 ⁶ / ₈ .	None. 15°.	.25 D. .13 D.	
39	F.	36	O. D. .50 D axis 90. O. S. none or slight .25 D axis 150.	O. D. + .50 ^s C + .50 ^c axis 105 ⁶ / ₈ . O. S. + 1 ^s C + .50 ^c axis 150 ⁶ / ₈ .	15°. None.	None. .25 D.	As against the rule .25 D more than ophthalmometer reading.

TABLE I.—Astigmatism according to the Rule.—(Continued.)

Case.	Sex.	Age.	Ophthalmometer reading.	Glass selected after Mydriatic.	Difference in axes.	Difference in the amount of astigmatism.	Remarks.
40	F.	40	O. D. very slight .25 D axis 105. O. S. very slight .25 D axis 105.	O. D. + 1 st \bigcirc + .25° axis 165 $\frac{5}{8}$. O. S. + 1 st \bigcirc + .25° axis 180 $\frac{5}{8}$.	60°. 75°.	None. None.	
41	F.	23	O. D. .75 D axis 105. O. S. .50 or .75 D axis 75.	O. D. + .75 st \bigcirc + .50° axis 105 $\frac{5}{8}$. O. S. + 1 st \bigcirc + .62° axis 75 $\frac{5}{8}$.	None. None.	.25 D. .12 D.	
42	M.	23	O. D. 3.50 D axis 5. ● O. S. 2 D axis 160.	O. D. + 1.50 st \bigcirc — 3° axis 5 $\frac{5}{8}$. O. S. — 1.50° axis 160 $\frac{5}{8}$.	None. None.	.50 D. .50 D.	
44	F.	19	O. D. .50 or .75 D axis 75. O. S. .50 or .75 D axis 90.	O. D. + 1 st \bigcirc + .25° axis 75 $\frac{5}{8}$. O. S. + 1 st \bigcirc + .25° axis 90 $\frac{5}{8}$.	None. None.	.50 D. .50 D.	
45	M.	62	O. D. 1 or 1.25 D axis 120. O. S. .75 or 1 D axis 60.	O. D. + 2 nd \bigcirc + 1° axis 120 $\frac{5}{8}$. O. S. always amblyopic.	None. .....	.25 D.	
46	F.	40	O. D. .75 D axis 75 or 90. O. S. .50 D axis 105.	O. D. + 1.75 st \bigcirc + .62° axis 75 $\frac{5}{8}$. O. S. + 1.75 st \bigcirc + .25° axis 90 $\frac{5}{8}$.	None. 15°.	.12 D. .25 D.	
47	M.	33	O. D. .50 D axis 120. O. S. .50 D axis 105.	O. D. + .50° axis 120 $\frac{5}{8}$. O. S. + .50° axis 105 $\frac{5}{8}$.	None. None.	None. None.	
48	M.	37	O. D. .75 D axis 90. O. S. .50 or .75 D axis 105.	O. D. + 2.50 st \bigcirc + .62° axis 90 $\frac{5}{8}$. O. S. + 2.25 st \bigcirc + .50° axis 105 $\frac{5}{8}$.	None. None.	.12 D. .25 D.	
50	M.	26	O. D. .50 D axis 90. O. S. .50 D axis 90.	O. D. + 1 st \bigcirc .62° axis 90 $\frac{5}{8}$. O. S. + 1 st \bigcirc + .50° axis 90 $\frac{5}{8}$.	None. None.	.12 D. None.	
51	F.	25	O. D. 3.50 D axis 10. O. S. 3.50 D axis 180.	O. D. — .50° \bigcirc — 3.50° axis 10 $\frac{5}{8}$. O. S. — .50° \bigcirc — 3.50° axis 180 $\frac{5}{8}$.	None. None.	None. None.	
52	F.	25	O. S. .50 D axis 75. O. D. .50 D axis 90.	O. D. + 1.25 st \bigcirc + .50° axis 90 $\frac{5}{8}$. O. S. + 1.25 st \bigcirc + .62° axis 75 $\frac{5}{8}$.	None.	None. .50 D.	
54	M.	42	O. D. .50 D axis 90. O. S. .50 D axis 90.	O. D. + 3 $\frac{5}{8}$. O. S. + 4 $\frac{5}{8}$.	..... .....	.50 D. .50 D.	
55	M.	20	O. D. .50 D axis 90. O. S. .50 D axis 105.	O. D. + .75 st \bigcirc + .25° axis 90 $\frac{5}{8}$. O. S. + .75 st \bigcirc + .25° axis 105 $\frac{5}{8}$.	None. None.	.25 D. .25 D.	
56	M.	44	O. D. .75 D axis 105. O. S. .50 D axis 90.	O. D. + .50° axis 105 $\frac{5}{8}$. O. S. + .25° axis 90 $\frac{5}{8}$.	None. None.	.25 D. .25 D.	
57	M.	14	O. D. 1.25 D axis 90. O. S. 1.50 D axis 90.	O. D. + 5 st \bigcirc + .75° axis 105 $\frac{5}{8}$. O. S. + 4 st \bigcirc + 1.25° axis 90 $\frac{5}{8}$.	15°. None.	.50 D. .25 D.	
58	F.	35	O. D. .75 D axis 90. O. S. 1 D axis 105.	O. D. + 1.25 st \bigcirc + .50° axis 90 $\frac{5}{8}$. O. S. + 1.25 st \bigcirc + .62° axis 105 $\frac{5}{8}$.	None. None.	.25 D. .38 D.	
59	M.	27	O. D. 2 D axis 85. O. S. 2 D axis 95.	O. D. — .75 st \bigcirc + 2° axis 85 $\frac{5}{8}$. O. S. — .50° \bigcirc + 1.75° axis 95 $\frac{5}{8}$.	None. None.	None. .25 D.	
60	M.	45	O. D. .50 D axis 90. O. S. .50 D axis 105.	O. D. + .50° \bigcirc + .50° axis 90 $\frac{5}{8}$. O. S. + .50° \bigcirc + .50° axis 105 $\frac{5}{8}$.	None. None.	None. None.	
61	F.	12	O. D. .75 D axis 60. O. S. .50 D axis 90.	O. D. + 3.50 st \bigcirc + .50° axis 60 $\frac{5}{8}$. O. S. + 3.50 st \bigcirc + .25° axis 90 $\frac{5}{8}$.	None. None.	.25 D. .25 D.	
63	F.	15	O. D. .50 D axis 75. O. S. .50 D axis 105.	O. D. + .75 st \bigcirc + .25° axis 75 $\frac{5}{8}$. O. S. + .75 st \bigcirc + .25° axis 105 $\frac{5}{8}$.	None. None.	.25 D. .25 D.	
65	F.	41	O. D. .50 D axis 105. O. S. .50 D axis 75.	O. D. + 1 st \bigcirc + .25° axis 105 $\frac{5}{8}$. O. S. + 1 st \bigcirc + .25° axis 75 $\frac{5}{8}$.	None. None.	.25 D. .25 D.	
66	F.	40	O. D. .25 D axis 105. O. S. .25 D axis 90.	O. D. + .75 st \bigcirc + .25° axis 105 $\frac{5}{8}$. O. S. + .75 st \bigcirc + .25° axis 90 $\frac{5}{8}$.	None. None.	None. None.	
68	M.	41	O. D. 1 D axis 75. O. S. 1 D axis 105.	O. D. + .50° \bigcirc + .87° axis 75 $\frac{5}{8}$. O. S. + .25° \bigcirc + 1° axis 105 $\frac{5}{8}$.	None. None.	.12 D. None.	
69	F.	29	O. D. 1.25 D axis 90. O. S. 1 D axis 105.	O. D. + .75 st \bigcirc + 1° axis 90 $\frac{5}{8}$. O. S. + .75 st \bigcirc + .75° axis 105 $\frac{5}{8}$.	None. None.	.25 D. .25 D.	
70	M.	19	O. D. 2.50 D axis 95. O. S. 2.50 D axis 85.	O. D. + 3.75 st \bigcirc + 2° axis 95 $\frac{5}{8}$. O. S. + 4 st \bigcirc + 2° axis 85 $\frac{5}{8}$.	None. None.	.50 D. .50 D.	
71	F.	29	O. D. 3.50 D axis 60. O. S. 2 D axis 105.	O. D. — .75 st \bigcirc + 3.25° axis 60 $\frac{5}{8}$. O. S. + 1.75° axis 95 $\frac{5}{8}$.	None. 10°.	.25 D. .25 D.	
73	F.	33	O. D. .50 D axis 90. O. S. .50 D axis 75.	O. D. + 1 st \bigcirc + .50° axis 90 $\frac{5}{8}$. O. S. + 1 st \bigcirc + 62° axis 75 $\frac{5}{8}$.	None. None.	None. .12 D.	
74	F.	32	O. D. 3 D axis 75. O. S. .50 D axis 90.	O. D. + 2 nd \bigcirc + 3° axis 75 $\frac{5}{8}$. O. S. + 1 st \bigcirc + .37° 90 $\frac{5}{8}$.	None. None.	None. .13 D.	
75	M.	24	O. D. 1 D axis 105. O. S. .25 D axis 105.	O. D. + .25 st \bigcirc + .50° axis 75 $\frac{5}{8}$. O. S. + .25 st \bigcirc + .25° axis 105 $\frac{5}{8}$.	30°. None.	.50 D. None.	
76	F.	35	O. D. 1 D axis 105. O. S. .50 D axis 90.	O. D. + 2.50 st \bigcirc + .87° axis 105 $\frac{5}{8}$. O. S. + 2.75 st \bigcirc + .50° axis 90 $\frac{5}{8}$.	None. None.	.12 D. None.	
77	M.	23	O. D. 1.50 D axis 90. O. S. 1 D axis 90.	O. D. — .50° \bigcirc + 1.50° axis 90 $\frac{5}{8}$. O. S. — .25° \bigcirc + .87° axis 90 $\frac{5}{8}$.	None. None.	None. .12 D.	
78	M.	42	O. D. .75 D axis 105. O. S. .25 D axis 90.	O. D. + .25 st \bigcirc + .62° axis 105 $\frac{5}{8}$. O. S. + .50 $\frac{5}{8}$.	None. .....	.13 D. .25 D.	
79	M.	42	O. D. 1 D axis 95. O. S. 1 D axis 105.	O. D. + .75 st \bigcirc + 1° axis 95 $\frac{5}{8}$. O. S. + .75 st \bigcirc + .75° axis 105 $\frac{5}{8}$.	None. None.	None. .25 D.	
80	F.	12	O. D. .25 D axis 105. O. S. .50 D axis 90.	O. D. + 1 st \bigcirc + .37° axis 105 $\frac{5}{8}$. O. S. + 1.50° \bigcirc + .25° axis 90 $\frac{5}{8}$.	None. None.	.12 D. .25 D.	.12 D. more than ophthalmometer record.

TABLE I.—*Astigmatism according to the Rule.*—(Continued.)

Case.	Sex.	Age.	Ophthalmometer reading.	Glass selected after mydriatic.	Difference in axes.	Difference in the amount of astigmatism.	Remarks.
81	M.	15	O. D. .50 D axis 75. O. S. .50 D axis 105.	O. D. + .90° \oslash + .25° axis 75 $\frac{6}{5}$. O. S. + .90° \oslash + .25° axis 105 $\frac{6}{5}$.	None.	.25 D.	
83	F.	18	O. D. 1 D axis 105. O. S. .75 D axis 75.	O. D. + 1° \oslash + .62° axis 105 $\frac{6}{5}$. O. S. + 1° \oslash + .62° axis 75 $\frac{6}{5}$.	None.	.38 D.	
85	F.	25	O. D. 1.25 D axis 90. O. S. 1 D axis 105.	O. D. + 1.50° \oslash + .87° axis 90 $\frac{6}{5}$. O. S. + 1.50° \oslash + .75° axis 105 $\frac{6}{5}$.	None.	.38 D.	
86	M.	37	O. D. 1 D axis 90. O. S. 1.25 D axis 105.	O. D. + 1° axis 90 $\frac{6}{5}$. O. S. + 1.25° axis 105 $\frac{6}{5}$.	None.	None.	
87	F.	12	O. D. .25 D axis 75. O. S. .25 D axis 90.	O. D. + 3.75° \oslash + .25° axis 75 $\frac{6}{5}$. O. S. + 3.50° \oslash + .25° axis 90 $\frac{6}{5}$.	None.	None.	
88	F.	18	O. D. 1.50 D axis 90. O. S. .50 D axis 90.	O. D. + 1.25° \oslash + 1° axis 90 $\frac{6}{5}$. O. S. + 2.25° \oslash + .25° axis 90 $\frac{6}{5}$.	None.	.50 D.	
89	F.	28	O. D. 1.25 D axis 90. O. S. 6 D axis 85.	O. D. — .50° \oslash + 1° axis 90 $\frac{6}{5}$. O. S. — 3° \oslash + 5.50° axis 85 $\frac{6}{5}$.	None.	.25 D.	
90	F.	35	O. D. .25 D axis 90. O. S. .25 D axis 90.	O. D. + 1° \oslash + .25° axis 90 $\frac{6}{5}$. O. S. + 1° \oslash + .25° axis 90 $\frac{6}{5}$.	None.	None.	
91	M.	12	O. D. .50 D axis 90. O. S. .50 D axis 90.	O. D. + .75° \oslash + .25° axis 90 $\frac{6}{5}$. O. S. + .75° \oslash + .25° axis 90 $\frac{6}{5}$.	None.	.25 D.	
92	M.	30	O. D. 1 D axis 75. O. S. 1.25 D axis 105.	O. D. + .75° axis 75 $\frac{6}{5}$. O. S. + 1° axis 105 $\frac{6}{5}$.	None.	.25 D.	
93	F.	10	O. D. .50 D axis 90. O. S. .50 D axis 90.	O. D. + 1.25° \oslash + .25° axis 90 $\frac{6}{5}$. O. S. + 1.25° \oslash + .25° axis 90 $\frac{6}{5}$.	None.	.25 D.	
94	F.	24	O. D. 1.25 D axis 90. O. S. 1.50 D axis 95.	O. D. + 5.50° \oslash + 1° axis 75 $\frac{6}{5}$. O. S. + 3.50° \oslash + 1.25° axis 95 $\frac{6}{5}$.	.15°.	.25 D.	
95	F.	25	O. D. 2.50 D axis 180. O. S. 2.50 D axis 180.	O. D. — 6.50° \oslash — 2.25° axis 180 $\frac{6}{5}$. O. S. — 5° \oslash — 2.50° axis 180 $\frac{6}{5}$.	None.	.25 D.	
97	F.	33	O. D. .25 D axis 90. O. S. .50 D axis 120.	O. D. + 1.50° \oslash + .25° axis 90 $\frac{6}{5}$. O. S. + 1° \oslash + .25° axis 120 $\frac{6}{5}$.	None.	None.	
98	F.	25	O. D. .25 D axis 90. O. S. 1.50 D axis 90.	O. D. + 2° \oslash + .25° axis 90 $\frac{6}{5}$. O. S. + 3.50° \oslash + 1.25° axis 95 $\frac{6}{5}$.	None.	.25 D.	
99	M.	23	O. D. 2.50 D axis 90. O. S. 1.50 D axis 90.	O. D. + 7° \oslash + 2° axis 90 $\frac{6}{5}$. O. S. + 7° \oslash + 1° axis 90 $\frac{6}{5}$.	None.	.50 D.	
100	F.	30	O. D. .50 D axis 180. O. S. .50 D axis 180.	O. D. — .50° \oslash — .50° axis 180 $\frac{6}{5}$. O. S. — .50° axis 180 $\frac{6}{5}$.	None.	None.	

One case of astigmatism according to the rule occurs in Table II.

TABLE II.—*Astigmatism Contrary to the Rule.*

Case.	Sex.	Age.	Ophthalmometer reading.	Glass selected after mydriatic.	Difference in axes.	Difference in the amount of astigmatism.	Remarks.
1	F.	26	O. D. 2 D axis 90. O. S. 2 D axis 105.	O. D. — 7° \oslash — 2° axis 90 $\frac{6}{5}$. O. S. — 7° \oslash — 2° axis 105 $\frac{6}{5}$.	None.	None.	
8	F.	25	O. D. 1 D axis 115. O. S. .50 D axis 55.	O. D. — .75° axis 115 $\frac{6}{5}$. O. S. — .62° axis 55 $\frac{6}{5}$.	None.	.25 D.	
37	F.	38	O. D. Astigmatism absent. O. S. 1 D axis 165.	O. D. + 1.50° \oslash + .50° axis 180 $\frac{6}{5}$. O. S. + 2.25° \oslash + 1.50° axis 165 $\frac{6}{5}$.	.....	.50 D.	.12 D more than ophthalmometer record.
43	F.	42	O. D. 1 D axis 15. O. S. 4 D axis 170.	O. D. — .50° \oslash + 1° axis 10 $\frac{6}{5}$. O. S. — 2° \oslash + 4° axis 170 $\frac{6}{5}$.	5°.	None.	
49	F.	20	O. D. 2.50 or 3 D axis 125. O. S. 1 D axis 15.	O. D. — 1.50° \oslash — 250° axis 120 $\frac{6}{5}$. O. S. — 3° \oslash — .87° axis 15 $\frac{6}{5}$.	5°.	None.	
53	F.	24	O. D. 1.50 D axis 90. O. S. 1.50 D axis 75.	O. D. — 1.75° \oslash — 1.75° axis 90 $\frac{6}{5}$. O. S. — .50° \oslash — 1.75° axis 75 $\frac{6}{5}$.	None.	.25 D.	According to rule.
62	M.	40	O. D. Astigmatism absent. O. S. Astigmatism absent.	O. D. + .50° \oslash + .12° axis 15 $\frac{6}{5}$. O. S. + .50° \oslash + .50° axis 180 $\frac{6}{5}$.	.....	.12 D.	.25 D more than ophthalmometer record.
64	M.	44	O. D. .50 D axis 180. O. S. .50 D axis 180.	O. D. + .50° \oslash + .25° axis 15 $\frac{6}{5}$. O. S. + .25° \oslash + .25° axis 180 $\frac{6}{5}$.	15°.	.25 D.	.50 D more than ophthalmometer record.

TABLE II.—*Astigmatism Contrary to the Rule.*—(Continued.)

Case.	Sex.	Age.	Ophthalmometer reading.	Glass selected from mydriatic.	Difference in axes.	Difference in the amount of astigmatism.	Remarks.
67	F.	38	O. D. .50 D axis 15. O. S. .75 D axis 165.	O. D. + 1.25 ^a \bigcirc + .75 ^e axis 15 $\frac{5}{8}$. O. S. + 1.50 ^a \bigcirc + .87 ^e axis 165 $\frac{5}{8}$.	None. None.	.25 D. .12 D.	.25 D more than ophthalmometer record. .12 D more than ophthalmometer record.
72	F.	46	O. D. .50 D axis 180. O. S. .50 D axis 105.	O. D. + .50 ^e axis 180 $\frac{5}{8}$. O. S. — .50 ^e axis 105 $\frac{5}{8}$.	None. None.	None. None.	
82	F.	43	O. D. .50 D axis 15. O. S. .25 D axis 165.	O. D. + 1.50 ^a \bigcirc + .75 ^e axis 15 $\frac{5}{8}$. O. S. + 1.25 ^a \bigcirc + .25 ^e axis 165 $\frac{5}{8}$.	None. None.	.25 D. None.	.25 D more than ophthalmometer record.
84	F.	46	O. D. .50 D axis 135. O. S. Astigmatism absent.	O. D. + .50 ^e axis 135 $\frac{5}{8}$. O. S. + .25 ^e axis 180 $\frac{5}{8}$.	None.	None. .25 D.	

Two eyes with astigmatism contrary to rule are placed in Table I.

TABLE III.—*No Astigmatism with ophthalmometer.*

Case.	Sex.	Age.	Ophthalmometer reading.	Glass selected after Mydriatic.	Difference in axes.	Difference in the amount of astigmatism.	Remarks.
5	M.	49	O. D. No astigmatism. O. S. No astigmatism.	O. D. None $\frac{5}{8}$. O. S. None $\frac{5}{8}$.	.....	.....
12	M.	30	O. D. No astigmatism. O. S. No astigmatism.	O. D. — 2 ^a $\frac{5}{8}$. O. S. — 2 ^a $\frac{5}{8}$.	.....	.....
16	M.	34	O. D. No astigmatism. O. S. No astigmatism.	O. D. + .62 ^e axis 15 $\frac{5}{8}$. O. S. + .50 ^a \bigcirc + .50 ^e axis 180 $\frac{5}{8}$.	.....	.62 D. .50 D.	
17	M.	8	O. D. No astigmatism. O. S. No astigmatism.	O. D. + 1.25 ^a $\frac{5}{8}$. O. S. + 1.25 ^a $\frac{5}{8}$.	.....	.....
19	M.	51	O. D. No astigmatism. O. S. No astigmatism.	O. D. + .75 ^a \bigcirc + .25 ^e axis 15 $\frac{5}{8}$. O. S. + 1 ^a \bigcirc + .25 ^e axis 165 $\frac{5}{8}$.	.....	.25 D. .25 D.	
20	M.	37	O. D. No astigmatism. O. S. No astigmatism.	O. D. None $\frac{5}{8}$. O. S. + .62 ^e axis 15 $\frac{5}{8}$.	.....	.....	.62 D.
28	M.	20	O. D. No astigmatism. O. S. No astigmatism.	O. D. + .75 ^a \bigcirc + .25 ^e axis 150 $\frac{5}{8}$. O. S. + .75 ^a \bigcirc + .25 ^e axis 30 $\frac{5}{8}$.	.....	.25 D. .25 D.	
96	F.	32	O. D. No astigmatism. O. S. No astigmatism.	O. D. + 1.50 ^a $\frac{5}{8}$. O. S. + 1.50 ^a $\frac{5}{8}$.	.....	.....

Four cases with astigmatism according to the ophthalmometer but none with mydriasis are found in Table II., and two cases are recorded in Table I.

tomed to estimate the width of a millimetre or even of a fraction of a millimetre.

Analysis of the Tables.—There were one hundred and fifty eyes in which the ophthalmometer recorded astigmatism according to the rule. In one hundred and thirty-four of these eyes the axis of the cylinder found with the aid of mydriasis corresponded with that determined with the instrument; in sixteen eyes there was a difference in this respect, the least difference being five degrees, the greatest seventy-five degrees. In the latter case the ophthalmometer recorded distinctly a slight astigmatism (.25 D) according to the rule, but the patient accepted positively the same degree of astigmatism, but with the axis of the glass contrary to the rule.

In thirty-five eyes the amount of astigma-

tism found with the instrument exactly corresponded with that revealed by mydriasis, but in one hundred and fifteen eyes there was a difference in this respect. In six of them the mydriatic correction was slightly greater in amount than that found with the ophthalmometer,—four times, .12 D; and twice, .25 D. In the remaining one hundred and nine eyes the ophthalmometer reading gave a greater degree of astigmatism than the mydriatic measurement,—twenty-five times, .12 D; sixty-five times, .25 D; four times, .37 D; fourteen times, .50 D; and once, .75 D; or, in other words, the average error was a little less than half a dioptre, being exactly .2613 D.

There were twenty-one eyes in which the ophthalmometer recorded astigmatism con-

trary to the rule. In eighteen of these eyes the axis of the cylinder found with the aid of mydriasis corresponded with that determined by the instrument; in three eyes there was a difference in this respect, the least difference being five degrees, and the greatest fifteen degrees. The amount of astigmatism was identical in nine eyes, but was different in twelve eyes. In eight it was more with mydriasis than the ophthalmometer recorded, and in four less. The average increase in the degree of astigmatism found with mydriasis over that recorded with the ophthalmometer was less than half a dioptre, or exactly .295 D.

There were twenty-two eyes in which the ophthalmometer recorded no astigmatism. In ten of these eyes mydriasis also failed to reveal astigmatism, but in twelve an astigmatism was developed after the use of the drug,—once with the rule and eleven times contrary to the rule. The case with the rule was only .12 D, and for practical purposes may be omitted. In the remaining eleven cases the amount of astigmatism varied from .25 D to .62 D, with an average of about .384 D. To recapitulate these results, we have:

a. There were one hundred and fifty eyes with astigmatism according to the rule, with—

	Eyes.
1. Correspondence in axes in.....	134
2. Difference in axes in.....	16
	<hr/> 150
1. Exact correspondence in amount of astigmatism in.....	35
2. Difference in amount of astigmatism in.....	115
	<hr/> 150
1. Astigmatism greater with mydriatic than with ophthalmometer in.....	6
2. Astigmatism greater with ophthalmometer than with mydriatic in.....	109
	<hr/> 115

If to this last total the thirty-five eyes in which there was exact correspondence in the amount of astigmatism be added, we have again a grand total of one hundred and fifty eyes.

b. There were twenty-one eyes with astigmatism contrary to the rule, with—

	Eyes.
1. Correspondence in axes in.....	18
2. Difference in axes in.....	3
	<hr/> 21

	Eyes.
1. Exact correspondence in amount of astigmatism in.....	9
2. Difference in amount of astigmatism in.....	12
	<hr/> 21
1. Astigmatism greater with mydriatic than with ophthalmometer in.....	8
2. Astigmatism greater with ophthalmometer than with mydriatic in.....	4
	<hr/> 12

If to this last total be added the nine eyes in which there was exact correspondence in the amount of astigmatism, we have a grand total of twenty-one eyes.

c. There were twenty-two eyes in which the ophthalmometer recorded no astigmatism, with—

	Eyes.
1. No astigmatism found with mydriasis in.....	10
2. Astigmatism found with mydriasis in.....	12
	<hr/> 22
1. Astigmatism according to the rule in (only .12 D).....	1
2. Astigmatism contrary to the rule in (.25 to .62 D; average; .384 D).....	11
	<hr/> 12

d. There were five eyes in which the ophthalmometer recorded astigmatism, but with—

	Eyes.
1. No astigmatism with mydriasis in.....	5

In each of these eyes the astigmatism was according to the rule, and the amount .5 D. Two eyes were practically blind,—one from detachment of the retina and the other from congenital amblyopia,—and hence these are of no importance in the result:

	Eyes.
1. Astigmatism according to the rule.....	150
2. Astigmatism contrary to the rule.....	21
3. Astigmatism absent according to ophthalmometer.....	22
4. Astigmatism present according to ophthalmometer, but absent with mydriasis.....	5
5. Practically blind.....	2
	<hr/> 200

REMARKS.

1. *The Axis of the Cylinder.*—In the one hundred and seventy-one eyes in which it was possible to institute a comparison in the axes of the cylindrical glasses obtained by the two methods of measurement, there was exact correspondence in one hundred and fifty-two eyes, or in 88.9 per cent., and failure in correspondence in nineteen, or 11.1 per cent.

In regard to the eleven per cent. of failures, it should be stated that so much depends upon perfect illumination, steadiness of the patient's eyes, and, above all, upon an exact

level of the two eyes, that it is more than probable that this percentage in part represents some inaccuracy of the observer rather than of the instrument. Davis* quotes a capital instance illustrating the care which must be exercised in this respect. He examined a patient in Javal's clinic, failing, however, to take the precaution to see that the patient's eyes were exactly level, and found she had an astigmatism at an axis 5° from the vertical. Javal then sat down to the instrument, sighted through the transverse slit, levelled the patient's eyes correctly, measured the astigmatism, and found the same amount that Davis had discovered, but with the axis vertical. The trial lenses confirmed his reading.

Moreover, it is a fact which has been pointed out a number of times by most careful observers that the axis of the glass determined under the mydriatic sometimes fails to correspond with that accepted by the patient after the return of accommodation. Personally, I have had little or no difficulty in this respect, but I would always adopt the mydriatic determination of the axis unless successive measurements with the ophthalmometer agreed in giving a different result from this, and then I would expect, after renewed mydriasis, to find a correspondence in the two methods; in other words, I would think my first mydriatic correction had been in error.

Finally, it should be remembered that the equation of error creeps into all methods of examination, and it seems to me not unlikely that any one of us, having determined the axis of a cylindrical glass in one hundred and seventy-one eyes under a mydriatic, would, if he repeated these examinations with renewed mydriasis, find at least a dozen eyes in which he would be inclined to alter the axis of the glass five or ten degrees from the first determination, especially in the weaker grades of astigmatism.

I am not unmindful of the occurrence of cases (one of which is recorded in the list, while several others could be quoted) in which there is a notable difference in the axes determined by the two methods; for example, the ophthalmometer giving distinctly astigmatism against the rule, and the patient accepting only, both with and without mydriasis, a cylinder with its axis according to the rule. These cases are probably explained by the presence of lenticular astigma-

tism, which the instrument is not capable of recognizing.

2. *The Amount of Corneal Astigmatism.*—In one hundred and seventy-one eyes in which a comparison is made between the amount of corneal astigmatism determined by the instrument and the total astigmatism under a mydriatic, there was exact correspondence in forty-four eyes, or 25.7 per cent., and failure in correspondence in one hundred and twenty-seven eyes, or 74.3 per cent.

In one hundred and nine eyes with astigmatism according to the rule, in which the astigmatism with the instrument was greater than the amount with mydriasis, the average increase was a little more than .25 D, being exactly .2513 D. In twelve eyes with astigmatism contrary to the rule, in which the astigmatism with the instrument was less than the amount with mydriasis, the average decrease was again a little more than .25 D, being exactly .295 D. This, we know from Javal's teaching, is the usual result, and that in weak astigmatism according to the rule, the ophthalmometer is from .25 to .50 D stronger than the subjective measurements with atropine. In astigmatism against the rule, the ophthalmometer is too weak by from .25 to .75 D.† On this account, Burnett has formulated the following law, to which he thinks there are only occasional exceptions: "For the total subjective astigmatism subtract .5 D from the corneal astigmatism when it is according to the rule, and add .5 D if the corneal astigmatism is against the rule." Bull, of Paris, quoted by Burnett, holds to a similar law, using, however, .75 D instead of .5 D. This Dr. Burnett considers too high, and I certainly agree with him, my own experience being that .5 D is quite sufficient to subtract from the corneal astigmatism when it is according to the rule. In fact, as I have already pointed out, in the majority of cases it seems to be somewhat less than this amount.

That there are exceptions to these rules Dr. Burnett admits, and I think every one who works with the ophthalmometer will find them. In the figures presented this evening we see that in six eyes with astigmatism according to the rule the total subjective astigmatism was greater than the corneal astigmatism measured with the instrument, and in four eyes with astigmatism contrary to the rule the amount of astigmatism revealed by the

* *Loc. cit.*

† See also description of the ophthalmometer by F. W. Ring, M.D., *loc. cit.*

ophthalmometer was greater than that found with a mydriatic. It should be stated in regard to these cases, however, that the difference was usually .12 D and only twice .25 D. Dealing with such weak degrees of astigmatism, it is just as likely that the eye of the observer was at fault as that the instrument made an inaccurate record. Again, we have exceptions to the rule, in the fact that there was an exact correspondence in the amount of astigmatism in thirty-five eyes with astigmatism according to the rule, and in nine eyes with astigmatism contrary to the rule. Here, again, with six exceptions, the astigmatism was of low degree (.25 or .50 D). In the six exceptions, however, it was more than 1 D, and ran as high as 3.50 D.

In twenty-two eyes the ophthalmometer failed to record astigmatism, and in ten of them no astigmatism was found with mydriasis, but in twelve of them a low degree of this refractive defect was demonstrated after the use of a mydriatic (.12 to .62 D). In all of the cases in which this occurred, save one, which, for practical purposes, as has already been pointed out, may be omitted, the astigmatism was contrary to the rule, and this again agrees with the teaching which has previously been given,—namely, when no astigmatism is found with the ophthalmometer, it is very probable that there is a real astigmatism against the rule from .25 to .50 D.

These results obtained by the measurement of two hundred eyes will, I think, suffice. They have been given without bias, and inasmuch as they practically confirm those of other observers who have found this ophthalmometer exceedingly useful in the determination of corneal astigmatism, they may be accepted as an additional indorsement of the many that are already on record as to the decided value of this instrument of precision.

Even if the ophthalmometer of Javal did nothing more than give us the axis of the principal meridian with a reasonable degree of certainty, which it undoubtedly does, it would be a very time-saving and valuable instrument in the office of the practical ophthalmologist. It has been stated that when the astigmatism exceeds 2 D, we may be certain that we are within five degrees of the true meridian or axis, and when the astigmatism is slight, there may be a possible error of ten degrees; but it is equally true that with the last model the precision is greater, and judging from my own experience, I would have a confidence in the axis of the glass

attained by this method of examination equal to that which I have with subjective examination under the fullest mydriasis, and when I am able to associate the two methods of examination, I am as certain of this point as it is possible to be.

But it is certainly fair to assume that within reasonable limits, and in the vast majority of cases, the ophthalmometer gives very exactly the degree of astigmatism, and that the combined observations of a number of observers permit the formulation of a rule, like other rules subject to exceptions, which tells us very nearly how much shall be subtracted from the ophthalmometer measurement when it is a case of astigmatism according to the rule, and how much shall be added to it when it is a case of astigmatism contrary to the rule. No one claims perfection for the instrument any more than he claims perfection for any other method of examining the eye, but when the ophthalmometer is carefully used, when the light is properly regulated and evenly distributed, when the eyes are carefully levelled, and when the observer, having corrected his own refractive defect, has acquired reasonable accuracy in the manipulation of the instrument, I certainly believe, and I think these tables fairly show, that Dr. Burnett is correct in stating that it is one of the most important instruments of positive diagnosis which has been given to us since the invention of the ophthalmoscope.

I am aware that much stress has been laid upon the fact that it is not an absolutely accurate measurer of astigmatism, and that disturbing factors come into play,—*e.g.*, watering of the eye of the patient, and, as Dr. Roosa aptly calls it, "the moving of the cornea under the instrument." It is for these reasons that the examinations must be constantly repeated before making the final record or before ordering the glass, just as we would repeat a mydriatic correction until we were satisfied that we had attained the highest degree of accuracy. It would be just as unreasonable to condemn the instrument on this account as it would be to condemn cataract extraction because one does not always have a docile patient and does not always make a classical section.

It is not the purpose of the present paper to discuss a question which is of much interest,—namely, how far the use of the ophthalmometer displaces mydriatics from their function in the correction of anomalies of refraction. It is needless for me in this assembly,

I think, to state that I am very far from believing that the sun of mydriasis has set, or, indeed, from believing that it ever will set. Nor do I believe that mydriasis gives a false impression of the proper axis of the cylindrical glass. I have elsewhere expressed myself very positively upon this subject, because I believe that the function of mydriasis in connection with the correction of anomalies of refraction does not alone involve paralysis of the ciliary muscle, but exercises a very much wider and more important office. I am perfectly willing to state, however, that careful work with the ophthalmometer will render the necessity for the use of prolonged mydriasis unnecessary in many cases, which, previous to a knowledge of this instrument or to any skill that may have been acquired in its use, would have been classed as examples suited to the employment of a mydriatic drug.

I cannot resist closing these remarks with a quotation from Dr. Burnett's first paper on "Ophthalmometry with the Ophthalmometer

of Javal and Schiötz," partly because I feel a personal indebtedness to him in learning the use of this instrument, and partly because it gives in a nut-shell what the instrument will do and what it will not do, and hence what we may expect of it.

"The ophthalmometer does not give us the refractive condition of the eye as a whole, and furnishes no positive indication as to the existence of myopia or hypermetropia, but it gives with exactness the radius of curvature of the cornea in all its meridians; and where there is a difference, it shows the direction of the principal meridians, and we can read on the instrument the amount of the difference in dioptries and fractions. The inventors claim that a difference of .25 D can be readily detected, and my own experience would substantiate this statement. The main question is, Is it practical? I most unhesitatingly answer, Yes. Taking all things into consideration, it seems to me the most practical of all of the instruments of precision we use in the diagnosis of astigmatism."

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